100° C.; for most hard drawn wire, however, the temperature of minimum internal friction is below 0° C.

(*f.*) The temporary change, whether of the nature of increase or decrease, wrought by alteration of temperature in the internal friction of metals, is in most cases enormously greater than the corresponding change in the torsional elasticity.

IV. "On a New Means of Converting Heat Energy into Electrical Energy." By WILLIARD E. CASE, of Auburn, New York, U.S.A. Communicated by W. H. PREECE, F.R.S. Received April 14, 1886.

It was shown by M. Henri Loewel (see "The Chemist," Part VIII, p. 476) that the addition of a solution of chromous chloride to stannous chloride caused a precipitate of metallic tin, the reaction forming chromic chloride.

On heating the solution to the boiling point, 212° F., it was found the precipitated metal was in a great measure redissolved, forming the original solution, chromous chloride and stannous chloride, without the liberation of hydrogen.

On cooling this solution the tin was again precipitated, the action continuing as often as the solution was heated and cooled.

As chromous chloride has a great affinity for oxygen, it is necessary the air should be excluded from the solution, otherwise the chromous chloride would be reduced to oxychloride of chrome, as Loewel states, and the reactions would cease to take place after a time, the stannous chloride formed during each heating remaining in solution.

I constructed, in the form of a simple galvanic cell, a small element with this solution, chromic chloride,* as the electrolyte, using tin as the positive, and platinum as the negative metal.

At 60° F. this element gives no electromotive force, although in this case, when the cell was first set up, it gave 0·0048 volt, owing probably to the presence of some foreign substance.

On the elevation of its temperature by the application of heat, the electromotive force rose and fell, as indicated in the diagram; the curves A, B, C, D, E, represent its increase during the rising temperature, and the curves F, G, H, I, J, its fall while cooling.

The irregularity of the curves A, B, C, D, E, was probably due to unequal heating.

At the termination of the experiment, when the cell had cooled down to 60° F., no electromotive force was observed, as indicated on

* The solution used was made by combining chromium trioxide with hydrochloric acid, and heating.

the diagram, of which the abscissæ are proportional to the electromotive forces, the ordinates to the temperatures Fahrenheit.

The highest electromotive force was 0·2607 volt at 197° F., the highest degree to which the temperature was raised.

If the platinum be replaced by a negative electrode of carbon, the electromotive force will be higher. It may be of interest to mention that the action of this element during heating is entirely different from that of the galvanic battery during a similar elevation of its temperature.

W. H. Preece, Esq., F.R.S. (see "The Effects of Temperature on the Electromotive Force and Resistance of Batteries," "Proc. Roy. Soc.," vol. 36, p. 48), states "that changes of temperature do not practically affect electromotive forces, but that they materially affect the internal resistance of cells."

When the temperature of this element was lowered to about 145° F., the reactions before mentioned took place.

The tin taken up by the solution during heating commenced to precipitate, increasing as the temperature lowered, and the metal fell to the bottom of the cell in a form to be again utilised in the generation of the current.

The amount of local action or chemical corrosion which took place above 150° F. was excessive, but the metal taken up by the solution was very much less when the temperature of the electrolyte was not raised above the point of precipitation, 140° F.

The metal taken up below this point appears to be precipitated under the same conditions as that taken up at higher temperature, and seems to be precipitated whether the circuit be open or closed.

It will be seen on the curves F, G, H, I, J, with falling temperature that the electromotive force increased between 150° F. and 140° F., this might have been due to the reactions which took place during the precipitation of the metal.

Further investigations to determine the efficiency of this element would be of interest.

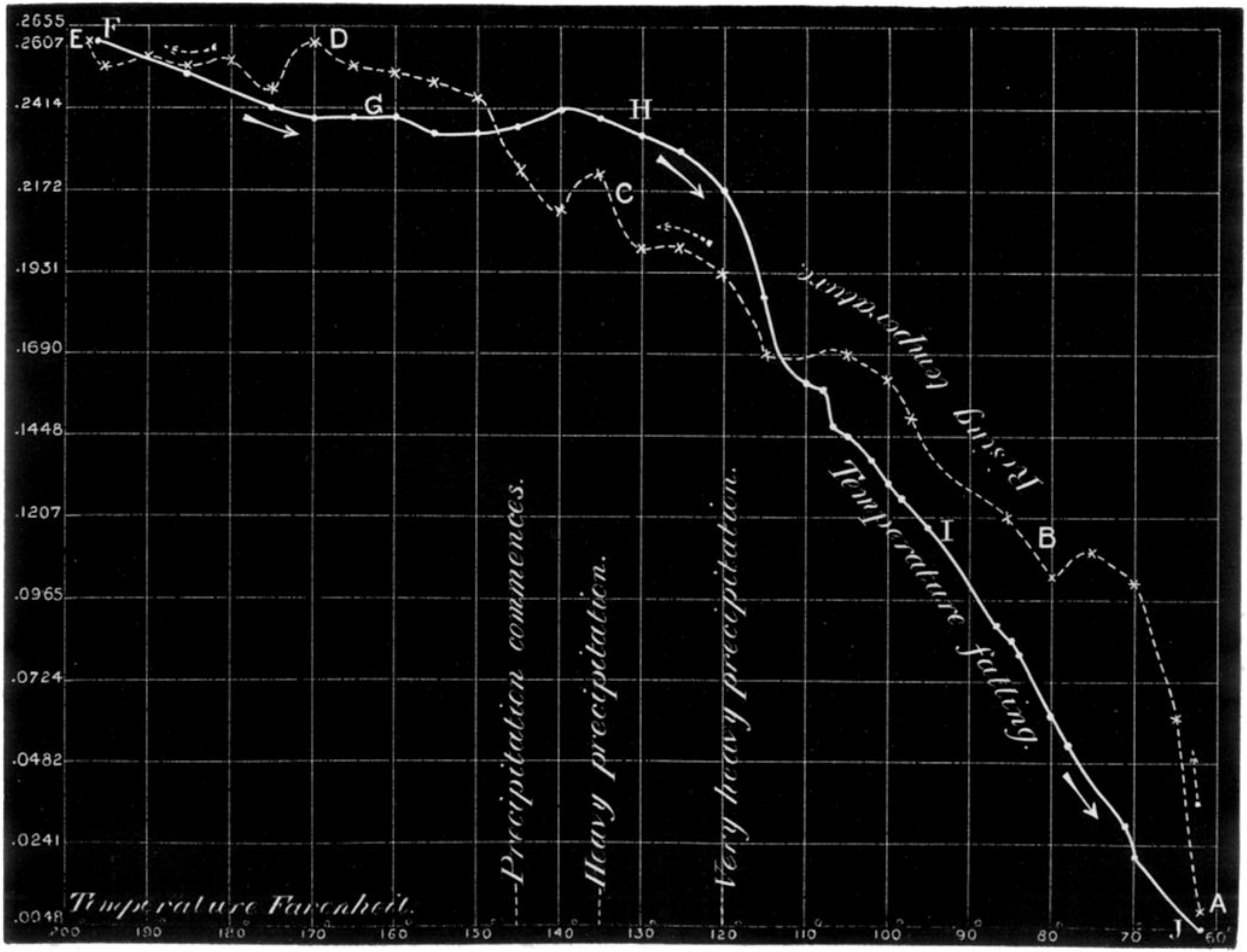
V. "Further Discussion of the Sun-spot Spectra Observations made at Kensington." By J. Norman Lockyer, F.R.S. Communicated to the Royal Society by the Solar Physics Committee. Received May 5, 1886.

I have recently discussed, in a preliminary manner, the lines of several of the chemical elements most widened in the 700 spots observed at Kensington.

The period of observation commences November, 1879, and extends to August, 1885. It includes, therefore, the sun-spot curve from a minimum to a maximum and some distance beyond.

It is perhaps desirable that I should here state the way in which the observations have been made. The work, which has been chiefly done by Messrs. Lawrance and Greening, simply consists of a survey of the two regions F—*b* and *b*—D.

The most widened line in each region—not the widest line, but the *most widened*, is first noted; its wave-length being given in the observation books from Ångström's map. Next, the lines which


.2655
.2607
.2414
.2172
.1931
.1690
.1448
.1207
.0965
.0724
.0482
.0241
.0048
E
F
D
G
H
C
I
B
A
J
Temperature Fahrenheit.
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
Precipitation commences.
Heavy precipitation.
Very heavy precipitation.
Temperature falling.
Pressure falling.